

EXHIBIT C

PULP AND PAPER
Chemistry and
Chemical Technology

Third Edition, Volume I

JAMES P. CASEY
Editor

*A WILEY-INTERSCIENCE
PUBLICATION*

JOHN WILEY & SONS
New York Chichester
Brisbane Toronto

UNIVERSITY OF MICHIGAN
LIBRARY
ANN ARBOR, MICHIGAN

Copyright © 1951, 1960, 1980 by John Wiley & Sons, Inc.

All rights reserved. Published simultaneously in Canada.

Reproduction or translation of any part of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful. Requests for permission or farther information should be addressed to the Permissions Department, John Wiley & Sons, Inc.

Library of Congress Cataloging in Publication Data:

Main entry under title:

Pulp and paper.

First-2d ed. written by J. P. Casey.

"A Wiley-Interscience publication."

Includes bibliographies and index.

1. Paper making and trade. 2. Wood-pulp.

L. Casey, James P., 1915-

TS1105.C29 1979 676 79-13435

ISBN 0-471-03175-5 (v. 1)

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

pulp^{1149,1150} if it is not properly dispersed. Pigment-coated book papers are readily deinked. Colored papers present somewhat of a problem in deinking, particularly if the dyes used in the paper are resistant, or fast, to chemicals. Most of the basic and acid dyes are destroyed by a caustic cook and can also be reduced with zinc hydrosulfite, although basic dyes tend to reoxidize on long standing. Most of the direct dyes can also be stripped with either caustic, chlorine, or hydrosulfite, but there are exceptions, such as the stilbene yellows, oranges, and turquoise blues, which are regarded as nondeinkable.¹¹⁵¹ The pigment types differ: (1) the chrome yellows and iron blues are destroyed by caustic, (2) the azoic types are regarded as nondeinkable, but can be discharged by direct chlorination, and (3) the phospho-tungstic-molybdic lakes present no problem since they are easily destroyed by hypochlorite bleach.

Chemicals Used in Deinking

Much deinking is done with plain alkali, but detergents and dispersing agents, such as soaps, sulfonated oils, bentonite, sodium metasilicate or silicate penthydrate, and other surface-active substances are sometimes used in combination with alkali. An ideal deinking formula would include an alkali to saponify the varnish or vehicle of the printing ink, a detergent to aid in the wetting of the pigment in the ink, a dispersing agent to prevent agglomeration of the pigment particles after release from the paper, and an absorption agent to bind the pigment and prevent redeposition on the fiber.

Alkali is used in the deinking formula for two purposes: (1) to remove rosin sizing from the paper and (2) to saponify the ink vehicle and release the pigment in the ink. There is generally about 0.5 to 2.0% ink on the weight of the paper; this must be completely removed if white pulp is to be produced. From the standpoint of ease of deinking, there are four principal types of inks:

1. Drying, oil-base inks.
2. Non-drying, oil-base inks.
3. Inks having a synthetic resin base.
4. Metallic inks with latex base.

Drying, oil-base inks that are slightly oxidized can be readily saponified by alkali. However, completely oxidized oil-base inks; nondrying, oil-base inks; and inks having a synthetic resin base cannot be completely saponified by alkali of ordinary concentration. Consequently special methods of deinking must be used for papers containing these inks. The various high-gloss and metallic inks in use today are extremely difficult to remove with alkali. Solvents (e.g., tri- or tetrachloroethylene, benzene, or carbon tetrachloride) or soaps and detergents can be used to aid in the deinking of these papers. Rosin is readily removed by saponification with alkali, and even the waxes used in sizing paper are melted and readily removed. Solvents are sometimes used to remove wax and polyethylene.¹¹⁵²